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(54) Title of the Invention: Method of Cleaning Inside of Water Supply Pipe etc. and Apparatus for the Same

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## DESCRIPTION

### 1. TITLE OF THE INVENTION

Method of Cleaning Inside of Water Supply Pipe etc. and  
Apparatus for the Same

### 2. CLAIM

(1) A method of cleaning the inside of a water supply pipe etc. in which the inside of the pipe is cleaned by employing the ultrasonic effect caused by intermittently discharging compressed air higher than a hydraulic pressure within the pipe through one end of a water tap of a water supply pipe to be cleaned from a cleaning apparatus installed on a floor into the water-sealed pipe and the pressure wave and impulse wave effect caused by opening another water tap.

(2) An apparatus for cleaning the inside of a water supply pipe etc., in which an detachable fitting is attached to one water tap attached to the water supply pipe to be cleaned, a drain valve is disposed on one side via a breeches pipe, a cleaning apparatus is disposed on the other side via a check valve, the cleaning apparatus is provided with an air jet timer for adjusting an amount of compressed-air discharge, an air stop timer for adjusting a compressed-air discharge interval, and a comprehensive work timer for adjusting a total time of a cleaning operation, and an electromagnetic valve to be opened/closed by a relay disposed in the air stop timer is

provided.

### 3. DETAILED DESCRIPTION OF THE INVENTION

Conventionally, in order to remove and clean scale etc. generated inside a water supply pipe, water is fulfilled and sealed within the pipe, and powerful compressed air is intermittently discharged through one side, the pressure is momentarily applied so as to cause the water hammer effect within the pipe, by which the scale etc. in the pipe is removed, washed, and cleaned. The operation is carried out in such a way that the water tap of the water supply pipe to be cleaned is detached, the compressed-air discharge apparatus separately attached is opened/closed by a magnet solenoid, which is caused to cooperate with a pressure switch attached to a compressor for feeding the compressed air, so that the apparatus is stopped by a stop timer after operating for a predetermined period of time. Moreover, many ice cubes are supplied beforehand into the pipe using the pipe washing and cleaning apparatus as mentioned above; a compression pressure is applied from one end rapidly so as to cause the water hammer effect in the pipe, by which the ice cubes are forced into the water-sealed pipe so as to remove the scale etc. and perform a cleaning operation.

However, as for such a conventional pipe washing and cleaning apparatus, when washing and cleaning the water supply pipe to be cleaned, the water tap needs to be detached in order

to attach the compressed-air the discharge apparatus. Further, the pressure switch provided in the compressor merely opens/closes the magnet solenoid so as to discharge the compressed air, so that a compressed-air discharge pressure setup must be performed by adjusting the pressure switch. Therefore, in the case of the washing and cleaning operation, the retained water in the pipe must be discharged before removing the water tap, which is the work taking time and leading a considerable loss of water due to a length of a pipe and a diameter of a pipe. Moreover, there is a problem in that it is not possible to adjust the number and intervals of discharges of the compressed air and an amount of compressed air per discharge by the length of the pipe and the diameter of the pipe, it is troublesome to adjust a setup pressure, and when it reaches the setup pressure, the pressure switch actuated, which is transmitted to the magnet solenoid to perform the discharge once, which reduces the pressure and takes time to recover the pressure.

Then, in order to solve such a conventional problem, the present invention sets the detachable fitting to be a compressed-air discharge opening to the water tap, without removing the water tap attached to the water supply pipe to be cleaned; according to the length of the pipe, the diameter of the pipe, and the condition inside the water supply pipe and a type of a cleaning object, the time of a product of the number of times of the air jet timer for adjusting the amount

of compressed air and the air stop timer for adjusting the compressed-air discharge interval and one cycle time of a jet stop multiplied by the number of times is set up by the comprehensive work timer; any one of them makes an electromagnetic valve open/close through the relay provided in the air stop timer, and makes it possible to simply vary the compressed-air discharge setup pressure by a pressure regulating valve; by installing an air tank, the compressed air is supplied into the pipe, without reducing the pressure, whereby the above-mentioned problem is solved and a method of cleaning the inside of a water supply pipe etc. and an apparatus for the same are provided.

Hereafter, based on the drawings in which an embodiment of the present invention is shown, the present invention will be described; a water supply pipe (1) to be cleaned is piped inside a building etc., to which a water tap (2) is attached suitably; a detachable fitting (3) is hung and attached to one water tap (2) out of those attached to the water supply pipe (1) without removing it from the water supply pipe (1). This detachable fitting (3) can be attached to and removed from the water tap (2) easily so that it may become the compressed-air discharge opening. A sewer valve (4) which drains the sewage from the compressed-air discharge opening is connected to one side through a breeches pipe (16). A check valve (5) which prevents the retained water in the water supply pipe (1) and sewage from bypassing is attached to the other side, and an electromagnetic

valve (9) is connected to the check valve (5) through a discharge pipe (17). An air jet timer (6) for varying an amount of compressed air at the time of opening the above-mentioned electromagnetic valve (9) is provided in the back. Furthermore, an air stop timer (7) for varying a compressed-air discharge interval by closing the electromagnetic valve (9) is connected. The air stop timer (7) is connected to the comprehensive work timer (12) so that the electromagnetic valve (9) may be opened/closed, a relay (8) connected to the air jet timer (6) and the air stop timer (7) is provided, and a working time is set up so as to stop the operation on the elapsing of the set up time. The comprehensive work timer (12) is incorporated into a circuit of a power source (13). The electromagnetic valve (9) is attached to the discharge pipe (17) and communicated, through the discharge pipe (17), with a pressure regulating valve (8) for pressure-regulating which can vary a compressed-air discharge set-up pressure simply and a pressure gauge (11) is mounted. Its indicating pressure is displayed by the pressure gauge (11).

The pressure regulating valve (8) is mounted on a compressed-air storage tank (14), and the compressed-air storage tank (14) is communicated with an oil free compressor (15), so as to prevent the set-up pressure from falling.

Since the present invention is arranged and constructed as described above, the detachable fitting (3) is attached to the water tap (2) attached to the water supply pipe (1) to be

cleaned; the compressed air is intermittently discharged into the water supply pipe (1) which is water-sealed; in order to cause the impact operation, the pressure regulating valve (8) adjusts the compressed-air discharge set-up pressure which varies based on the diameter and the length of the water supply pipe (1), and it is sent to the electromagnetic valve (9). As for the amount of compressed-air discharge for each time which varies based on the diameter and the length of the water supply pipe (1), the electromagnetic valve (9) is opened by the air jet timer (6) and closed on the elapsing of the set up time. Moreover, the discharge interval of the compressed air is similarly set up by the air stop timer (7), and the electromagnetic valve (9) is closed during the interval. After the set-up time has elapsed, when the air jet timer (6) returns and the compressed air is again discharged into the water supply pipe (1), the retained water in the water supply pipe (1) is shocked and generates fine air bubbles, which burst and become larger over time. An ultrasonic wave generated at this time peels impurities, such as scale adhering to an inner wall within the water supply pipe (1). By opening another water tap (2)', the impulse wave moves within the water supply pipe (1), and cleans and is discharged. According to the diameter and the length of the water supply pipe (1), the compressed-air discharge pressure, the amount of discharge for each time, and the discharge interval are set up beforehand. If the comprehensive work timer (12) is set up according to the time



which is derived by multiplying the total time of the air jet timer (6) and the air stop timer (7) with respect to the diameter and the length of the water supply pipe (1) which is rendered to be one cycle by the number of times, the cleaning apparatus (A) runs automatically and stops after the set up time has elapsed.

As described above, according to the present invention, the detachable fitting to be the compressed-air discharge opening can easily be attached to the water tap of the water supply pipe to be cleaned without detaching the water tap the cleaning operation can be carried out by opening/closing of the electromagnetic valve by means of the timer, the discharge amount of the compressed air, and the discharge interval. Since the comprehensive work timer can set the number of times to one cycle time calculated beforehand, it is possible to start the cleaning operation without discharging the water inside the water supply pipe, whereby the water consumption can be reduced and the working hours can be considerably reduced. Moreover, according to the diameter and the length of the water supply pipe, the type of a material to be cleaned, the compressed-air discharge pressure, the amount of discharge, the discharge interval, and the number of the discharges can be varied so as to raise the cleaning effect in the optimum state. Since it is supplied without causing a decreased pressure, there is an advantage that recovering time for compressor is not required and the cleaning time can be

shortened. Further, since the ultrasonic effect caused by intermittently discharging the compressed air into the water supply pipe which is water-sealed from one end of the water tap, and the pressure wave and impulse wave effect then caused by opening another water tap are used together, in the state where the water is sealed in the pipe, the hydraulic pressure is applied equally in all directions to the pipe within the water supply pipe. If the compressed air is discharged intermittently into the water supply pipe at this stage, it collides with the water in the water supply pipe and generates the fine air bubbles which gradually burst and become larger. When bursting, the ultrasonic wave is generated so that the foreign substances inside the water supply pipe are peeled off. The molecular structure of oil adhering to the inside of the water supply pipe is cut and caused to produce an emulsion and coexist with the water. Moreover, in the state where the water is still within the water supply pipe, each water tap is maintaining the hydrostatic pressure. However, when the compressed air is discharged into the water supply pipe, it changes into pressure energy which is accumulated within the water supply pipe. By opening of another water tap, the hydrostatic pressure is turned into a dynamic water pressure, so that the energy is transformed into the energy of velocity. A shock wave is produced, when the high pressure becomes the pressure wave in the water supply pipe and the bubbles move within the pipe at a high speed, so that the foreign substances,

such as the scale adhering to the inside of the water supply pipe, are peeled off and discharged together with the water which is turbulent through the another water tap, thus providing an advantage that an effective distance within a cleaning range is long and it is possible to clean easily without oil adhering, either.

#### 4. BRIEF DESCRIPTION OF THE DRAWINGS

The figure shows an apparatus of an embodiment showing a method of cleaning the inside of a water supply pipe etc. according to the present invention.

- (1) -- water supply pipe
- (A) -- cleaning apparatus
- (2) -- water tap
- (3) -- detachable fitting

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⑱ 給水管等の内部洗浄方法並びにその装置

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明 細 書

1. 発明の名称

給水管等の内部洗浄方法並びにその装置

2. 特許請求の範囲

①. 洗浄する給水管の給水栓の一端より水封されている管内に対し、床上に設置した洗浄装置より管内保有水圧より高い圧縮空気を断続的に発射させることによって起きる超音波効果とその後、他の給水栓を開けることによって、起きる圧力波、衝撃波効果を併用して、管内を洗浄するようにしたことを特徴とする給水管等の内部洗浄方法。

②. 洗浄する給水管に付いている一つの給水栓に自在取付金具を取付け、二又管を介して、一方に排水バルブ、他方に逆止弁を介して洗浄装置を配管し、その洗浄装置に圧縮空気発射量を調節するエア—噴出タイマー、圧縮空気発射間隔を調節するエア—停止タイマー、洗浄作業の総時間を調節する総合作業タイマーを設け、エア—停止タイマーに設けられた

リレーにより開閉する電磁弁を備えたことを特徴とする給水管等の内部洗浄装置。

3. 発明の詳細な説明

従来、給水管内部に生じたスケール等を除去清掃するためには管内に水を充満水封させて、一方から強力な圧縮空気を断続的に発射し、瞬間的に圧力を与えて、管内にウォーターハンマー作用を起させ、このウォーターハンマー作用によって、管内のスケール等を取り除き洗浄清掃を行っていた。この作業は洗浄の対象となる給水管の給水栓を取り外し、別に取り付けた圧縮空気の発射装置をマグネットソレノイドによって開閉するようになり、その作動は圧縮空気を送るコンプレッサーに取付けた圧力スイッチと連動させ、その装置は停止タイマーによって一定時間の作動の後停止するようにしていた。また前記の如き管洗浄清掃装置を用いて、あらかじめ管内に氷塊を多数投入し、一方より急激な圧縮圧力を加えて、管内にウォーターハンマー作用を起させ、これによって氷塊を水封する

管内に圧送せしめて、スケール等を取り除き洗浄作業を行っていた。

しかしながら、このような従来のパイプ洗浄清掃装置にあつては洗浄の対象となる給水管の洗浄清掃にあつては圧縮空気の発射装置の取り付けは給水栓を取り外さねばならず、又圧縮空気の発射はコンプレッサーに設けた圧力スイッチによりマグネットソレノイドが単純に開閉されるだけのことであり、圧縮空気発射圧力設定は圧力スイッチの調整によって行なわねばならなかった。そのため洗浄清掃作業するにあたり、給水栓を外す前に管内の保有水を排出せねばならず、管の長さ、管の径によって、多大な量の水のロスを生じると共に時間を要する作業であり、又圧縮空気を発射する回数、間隔、1回当りの発射圧縮空気の量を管の長さ、管の径によって調整することができなかったことと設定圧力の調整が面倒であり、設定圧力に達し圧力スイッチが作動し、マグネットソレノイドに伝わり発射されると1回の発射で圧力ダウン

を起し、その回復に時間がかかるという問題点があった。

そこで、本発明はこのような従来の問題点を解決するために洗浄の対象となる給水管に付いている給水栓を取り外すことなく圧縮空気発射口となる自在取付金具を給水栓にセットし、管の長さ、管の径、給水管内部の状況や洗浄対象物の種類によって、圧縮空気量を調整するエア-噴出タイマー、圧縮空気発射間隔を調整するエア-停止タイマーの回数や噴出停止の1サイクルタイムに回数を乗じた時間を総合作業タイマーにより設定し、いずれもエア-停止タイマーに設けられたリレーを通して、電磁弁を開閉させ、又圧縮空気発射設定圧力を圧力調整弁により簡単に可変できるようにし、エアタンクを設置することによって設定圧のダウンを起さずに圧縮空気を管内に供給することにより上記問題点を解決するようにしたことを特徴とする給水管等の内部洗浄方法並びにその装置を提供するにある。

以下本発明の一実施例を示す図面に基づいて説明すると、洗浄を対象とする給水管(1)は建造等内に配管され、適宜給水栓(2)が取付けられ、給水管(1)に取付けられている内の一つの給水栓(2)に給水管(1)より取り外すことなく、自在金具(3)を掛懸取付けセットする。この自在金具(3)は圧縮空気発射口となるように給水栓(2)に容易に取付け取り外しが出来るようにする。そして又管(18)を介して、一方に圧縮空気発射口よりの汚水を排水する排水バルブ(4)を連結すると共に他方には給水管(1)内の保有水及び汚水の防流を防止する逆止弁(5)を取付け、発射管(17)を介して電磁弁(9)を連結し、その後方に圧縮空気量を前記電磁弁(9)の開放時により可変させるためのエア-噴出タイマー(6)を設け、更に圧縮空気発射間隔を電磁弁(9)の開止により可変させるためのエア-停止タイマー(7)を連設し、このエア-停止タイマー(7)には電磁弁(9)を開閉動するように且又エア

-噴出タイマー(6)、及びエア-停止タイマー(7)に接続するリレー(8)を設けると共に作業時間を設定し、設定時間経過後作動を停止するようにした総合作業タイマー(12)を接続せしめ、この総合作業タイマー(12)を電源(13)の回路に組み入れる。電磁弁(9)は発射管(17)に取付けられ、圧縮空気発射設定圧を簡単に可変できる圧力調整用の圧力調整弁(8)を発射管(17)を介して連通せしめ、圧力計(11)を取り付ける。そしてその指持圧力は圧力計(11)によって表示される。

圧力調整弁(8)は圧縮空気貯溜タンク(14)上に設けられ、圧縮空気貯溜タンク(14)はオイルフリーコンプレッサー(15)に連通されて、設定圧の低下を防ぐ。

本発明は以上のように配設構成したから、洗浄の対象となる給水管(1)に付いている給水栓(2)に自在取付金具(3)を取り付け、水封されている給水管(1)内に圧縮空気を断続的に発射し、衝撃作用を起させるために給水管

(1)の径、長さにより変る圧縮空気発射設定圧を圧力調整弁(8)により調整し、電磁弁(9)に送られる。この電磁弁(9)は給水管(1)の径、長さによって変る1回当りの圧縮空気発射量をエアー噴出タイマー(6)によって開放され、設定時間経過後閉止される。又、圧縮空気の発射間隔も同様にエアー停止タイマー(7)によって設定し、その間電磁弁(9)は閉止される。設定時間経過後エアー噴出タイマー(6)は復帰し、再び圧縮空気を給水管(1)内に発射すると、給水管(1)内の保有水は衝撃を受け微粒子の気泡を発生し、時間の経過と共に破れつしながら大きくなり、この時発生する超音波は給水管(1)内の内壁面に付着するスケール等の夾雑物を剥離し、衝撃波は他の給水栓(2)を開口することによって、給水管(1)内を移動して洗浄排出される。給水管(1)の径、長さによってあらかじめ圧縮空気発射圧と1回当りの発射量、発射間隔をセットし、給水管(1)の径、長さに対してエアー

噴出タイマー(6)とエアー停止タイマー(7)の合計時間を1サイクルとし回数を乗じた時間によって、總合作業タイマー(12)をセットすれば自動的に作動し、セット時間経過後洗浄装置(A)は停止する。

本発明は以上のように洗浄の対象となる給水管の給水栓に圧縮空気発射口となる自在取付金具を給水栓を取り外すことなく容易に取付けることができると共に圧縮空気の発射量、発射間隔をタイマーにより電磁弁の開閉によって、洗浄作業ができ、その回数もあらかじめ計算された1サイクルタイムに總合作業タイマーをセットすることができるようにしたから、給水管内部の水を排出しないままで、洗浄作業にかかれるをもって、水の節約ともなり、作業時間が大巾に短縮できる。又給水管の径、長さ、被洗浄物の種類によって、圧縮空気発射圧、発射量、発射間隔、発射回数の可変によりそれに適した最良状態で洗浄効果を高めることができ、圧力低下を起さず供給されるので、コンプレッサー

回復時間の必要もなく、洗浄作業時間も短縮できる効果が得られる。又給水栓の一端より水封されている給水管内に圧縮空気を断続的に発射する事によって起きる超音波効果とその後他の給水栓を開放する事によって起きる圧力波、衝撃波効果を併用する事とした為、水封され給水管内部に於いて水が静止の状態では水圧は管のすべての方向に等しく働いており、この時給水管内に圧縮空気を断続的に発射すると給水管内の水に衝突して微粒子の気泡を作り次第にこわれて大きなものとなる。こわれる時超音波を発生し給水管内部の異物を剥離する。給水管内に付着する油分はその分子構造が切断され水とエマルジョンを作り水中に共存する。又給水管内で水が静止している状態では各給水栓は静水圧を保っているが圧縮された空気が給水管内に発射すると給水管内に圧力エネルギーとなって貯積される。このエネルギーは他の給水栓の開放より静水圧が動水圧になり速度のエネルギーに変換する。この高い圧力が給水管内に於いて圧

力波となり管内を気泡が高速で移動する時衝撃波を生じ給水管内面に付着しているスケール等の異物を剥離し乱流となった水と共に他の給水栓より流動排出されるので、清掃範囲の有効距離は長く油分も固着する事なく簡単に洗浄する事ができるという効果が得られる。

#### 4. 図面の簡単な説明

図面は本発明の給水管等の内部洗浄方法を示す一実施例の装置を示す構成図である。

図中

- (1) … 給水管 (A) … 洗浄装置
- (2) … 給水栓
- (3) … 自在取付金具

特 許 出 願 人 株式会社ホクカン

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